GRADES 8-12

HOUSEHOLD HAZARDOUS MATERIALS EDUCATION SUPPORT PROGRAM

SAFE, SMART,
SOLUTIONS FOR IOWA

PURPOSE

This is designed to educate students about the presence of household hazardous materials, (HHMs) along with alternative products and proper procedures for storing, recycling, and disposing of the materials. The ultimate goal is to help create an educated population that will lead the effort toward cleaner, safer, less-contaminated surface water and groundwater, the sources of Iowa's drinking water. While the executable time frame can be customized to the grade level and depth of student involvement the instructor wishes to explore, the program is designed to be a 5-10 class period project.

TABLE OF CONTENTS

III. Classroom Session #2 - How Household Hazardous Materials Contaminate Groundwater

A. A Study of Groundwater
B. Which HHMs Are Most Likely to Reach the Groundwater System?
C. How do HHMs reach Iowa's Waters?
    1. Point Sources
    2. Nonpoint Sources
D. Demonstration
E. Additional Research
F. Exercises
    1. Waterflow Demonstration
    2. Aquifer Sundae
    3. Storm Sewer Stencils
G. Other IDNR Resources

Quiz

IV. Classroom Session #3 – Proper Handling & Disposal of Household Hazardous Material

A. General Rules
B. IDNR Waste Management Assistance & RCCs
C. Paints & Solvents
D. Cleaners
E. Exercises
    1. Math
    2. The Dilution Solution

Quiz

V. Classroom Session #4 – Proper Handling & Disposal of Household Hazardous Material, Part 2

A. Automotive Products
B. Pesticides/Fertilizers
C. Exercises
    1. Keeping A Green Car
    2. Surveys
    3. Discussion

Quiz

VI. Classroom Session #5 – Alternatives To Household Hazardous Materials

A. Buy Smart
B. Safer Choices
C. Exercise - Baking Soda As A Safe Alternative

Quiz

VII. Project Summary

A. Review
B. Discussion of IDNR Slogan
C. IDNR Web Site Review
D. How Students Can Continue To Help
E. Exercise: Discussion: How should society address HHM?

Quiz

I. Classroom Introduction

A. EPA: Americans generate 1.6 million tons of household hazardous materials per year

B. The average home can accumulate about 100 pounds of HHMs.

C. According to the Iowa Poison Control Center, HHMs are the leading cause of accidental poisonings among children.

D. Improper use/disposal can put HHMs right into surface waters and groundwater.

E. The majority of Iowa's drinking water supply comes from groundwater.

II. Classroom Session #1 – Identifying Household Hazardous Materials

A. What Makes Products Hazardous?

1. Flammable/Combustible: Easily set on fire.
   a. Liquids that have a flash point less than 140 degrees F/60 degrees C.
   b. Materials other than liquids that are capable, under standard temperature and pressure, of causing fire by friction, absorption of moisture, or spontaneous chemical changes and, when ignited, burn so vigorously and persistently that they create a hazard.
   c. Flammable compressed gasses, including those that form flammable mixtures with air.
   d. Oxidizers that stimulate combustion of organic material.

2. Explosive/Reactive
    a. Unstable materials capable of undergoing violent chemical change (without detonating).
    b. Materials which react violently with water.
    c. Materials which form potentially explosive mixtures with water.
    d. Cyanide or sulfide bearing wastes, which, when exposed to pH conditions between 2 and 12.5, will generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.
    e. Materials capable of detonation or explosive reaction when subjected to a strong initiating source or if heated in confinement.
    f. Materials which are capable of detonation or explosive composition at standard temperature and pressure. *(alkali metals, peroxides, cyanide, and sulfide compounds).*

3. Corrosive: Chemical action can burn and destroy living tissue or metal on contact.
    a. Aqueous solutions with a pH less or equal to 2 or greater than 12.5.
    b. Liquid substances which corrode steel at a rate greater than 6.35 millimeters (0.250 inches) per year at a test temperature of 55 degrees C/130 degrees F.
    c. Most common laboratory acids and bases are corrosive, as well as some amines and solutions of certain metal salts (e.g., a 0.1M aqueous solution of ferric chloride has a pH of 2.0).

4. Toxic: Capable of causing injury or death through ingestion, inhalation, or absorption through the skin. Also capable of causing cancer and/or fetal harm. Toxicity is established through the Toxicity Characteristic Leaching Procedure (TCLP), which measures the tendency of certain toxic materials to be leached (extracted) from the waste material under conditions that waste would be exposed to in a landfill.

    The levels at which these chemicals are regulated in mixtures varies from 0.2 ppm to 400 ppm. For example, solutions that contain mercury at levels above 0.2 ppm are hazardous waste. These levels are very low, so if a waste contains one or more of these components it should be considered to be a hazardous waste unless analysis following the TCLP method shows that its concentration is below the regulatory limit.

B. Signal Words

1. Danger: Extremely flammable, corrosive, or highly toxic.
2. Poison: Highly toxic.
3. Caution: Mild to moderate hazard.
4. Warning: Moderate hazard.
5. “Non-toxic” and “biodegradable” lack regulatory definitions and are used for advertising purposes.

C. Hazardous Materials Around the House

1. Paints and Solvents
   a. Paint – Oil-Based (Flammable)
   b. Paint Thinner (Flammable)
   c. Rust Remover/Turpentine/Furniture Stripper (Flammable)
2. Cleaners
   a. Drain Openers/Kitchen-Bathroom Cleaners/Bleach (Corrosive/Toxic)
   b. Furniture Polish; Spot Removers (Flammable)
3. Automotive/Engine Products
   a. Used Motor Oil/Oil Filters (Toxic)
   b. Old Gasoline (Toxic/Flammable/Explosive)
   c. Antifreeze (ToxicFlammable)
   d. Car Batteries (Corrosive)
   e. Car Wax/Detergents (Toxic)
   f. Other Fluids (Windshield Wiper Fluid; Brake Fluid; Transmission Fluid) (Toxic)
4. Pesticides/Herbicides
   a. Weed Killer; Insecticides; Flea-Roach Powder; Rat/Mouse Poison; Mothballs (Poisonous); Flea Collars (Toxic)
   b. Wood Preservatives (Toxic/Flammable)
5. Miscellaneous
   a. Shoe Polish (Toxic)
   b. Pool Chemicals (Toxic)
   c. Arts & Crafts Materials (Toxic)
   d. Nail Polish Remover (Toxic/Flammable)

D. Exercises

1. Home Survey

   Objective – To show students that Household Hazardous Materials are real products that each one of them has in their homes.

   Materials – Take-home Household Hazardous Materials checklist (included in this packet).

   Procedure – Distribute a checklist of common household hazardous materials (attached) and have students, preferably with their parents (not only for supervision, but to extend the lesson), check their homes to see how many can be found. Can they find others not included on the list? (Remind students to handle products very carefully, to look at the containers only, and wash hands carefully when finished.)

2. Product Label Worksheet (IDNR)

   Objective – A "real life" lesson that products in the students' own homes contain harmful materials that must be responsibly handled.

   Materials – A variety of products containing Household Hazardous Materials, either brought by the teacher for classroom use, or that the students have in their homes. If the teacher conducts this in the classroom, it should be a demonstration only, and not permitting the students to handle the products. Use empty containers and pass around the class. Be sure to include a wide variety – pesticides, cleaners, solvents, etc.

   Procedure – If done in the students' homes, have students (with parents) read the warning labels found on product containers and make a list of the key words found on the warning labels. If done in the class, the instructor should read the labels to the class, and have each class member write down words they hear that would indicate the product is dangerous. Have students check ingredients for familiar chemicals that may surprise them (example: Lysol disinfectant spray is 79% ethanol).

   Divide into small groups and discuss keywords found on the label that warn of the products' danger. Have each group present the findings of their product to the class, along with their evaluation of how effective the label is and how it could be improved.

3. Label Identification: Match these HHM label warnings with the hazardous material or product that carries them:
   http://www.ehs.cornell.edu/lrs/labels.toc.htm

   BENZENE: STATEMENT OF HAZARDS: Cancer hazard (contains material which can cause cancer in humans). Risk of cancer depends on duration and level of exposure. Causes respiratory tract, skin and eye irritation. May cause blood disorders. May cause convulsions. May affect the central nervous system. May cause adverse reproductive effects. May cause brain damage. May cause hearing loss. May damage the lungs. May cause visual disturbances. Flammable liquid and vapor. May cause flash fire. PRECAUTIONARY STATEMENTS: Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Keep away from all ignition sources. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution. FIRST AID: Inhalation: Remove from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Maintain airway and blood pressure and administer oxygen if available. Skin contact: Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately.

TOLUENE: STATEMENT OF HAZARDS: Causes respiratory tract, skin and eye irritation. May cause blood disorders. May damage nerves. May affect the central nervous system. May cause adverse reproductive effects. May cause brain damage. May affect the heart. May affect the kidneys. May affect the liver. May damage the lungs. Flammable liquid and vapor. PRECAUTIONARY STATEMENTS: Keep away from all ignition sources. Avoid breathing vapor or mist. Avoid contact with eyes, skin and clothing. FIRST AID: Inhalation: Remove from exposure area to fresh air immediately. Perform artificial respiration if necessary. Skin contact: Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water. Eye Contact: Wash eyes immediately with large amounts of water or normal saline. Ingestion: Extreme care must be used to prevent aspiration. Gastric lavage with a cuffed endotracheal tube in place to prevent further aspiration should be done within 15 minutes. In the absence of depression or convulsions or impaired gag reflex, emesis can be induced using syrup of ipecac without increasing the hazard of aspiration. Get medical attention immediately.

IODINE: STATEMENT OF HAZARDS: Causes severe burns to mucous membranes. Causes skin and eye burns. Causes respiratory tract irritation, possibly severe. May cause convulsions. May cause adverse reproductive effects. May affect the kidneys. May damage the lungs. Strong oxidizer. Contact with other material may cause fire. PRECAUTIONARY STATEMENTS: Do not breathe dust. Do not get in eyes, on skin, or on clothing. Avoid repeated or prolonged contact. Keep from contact with clothing and other combustible materials. Store away from combustible materials. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. FIRST AID: Inhalation: Remove from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Skin contact: Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately.

WINDOW CLEANER - STATEMENT OF HAZARDS: Avoid contact with skin or eyes. Will irritate eyes. May cause skin irritation, drying or defatting of skin. PRECAUTIONARY STATEMENT: Avoid skin and eye contact. Wear rubber gloves when using this product. FIRST AID: Eye contact: Flush immediately with water for 20 minutes. Skin contact: Wash contaminated area with water and soap. If irritation persists, get medical attention. Inhalation: Remove to fresh air. Ingestion: Drink 1-2 glasses of water or milk. Do not administer anything by mouth to an unconscious person. Do not induce vomiting! Seek immediate medical attention.

MINERAL DEPOSIT REMOVER – STATEMENT OF HAZARDS: Causes severe burns to mucous membranes. Causes respiratory tract, skin and eye burns. May cause convulsions. May cause blindness. May affect the kidneys. May damage the lungs. PRECAUTIONARY STATEMENTS: Do not breathe vapor or mist. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution. FIRST AID: Inhalation: remove from exposure area to fresh air immediately. Perform artificial respiration if necessary. Skin contact: remove contaminated clothing and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (15-20 minutes). Eye contact: wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains (at least 15-20 minutes). Ingestion: Give large amounts of water or milk. Repeat if vomiting occurs. Ingested corrosive should be diluted approximately 100 times to render it harmless to tissues. Get medical attention immediately.

4. Quantitative Analysis of Lead In Hair Color Product

Note – This experiment was originally developed by Patrick Gormley of Lapeer East High School in Michigan, and posted on the school's Science Teachers' Resource Center Web site http://chem.lapeer.org/. It is assumed that users of this information are qualified science teachers who are aware of proper laboratory procedure, and chemical and apparatus usage. Safety precautions such as the use of goggles, aprons, gloves, and so forth are assumed. Furthermore, it is also assumed that all chemicals used will be disposed of properly according to Federal, state, and local regulations. Users of this information assume all responsibility for the use of that information.

Objective – Lead is a proven hazardous material that is often found in water supplies. How does it get there? One way is through the use of household materials that use lead as a chemical ingredient – such as hair dye. In this experiment you will analyze a commercial hair color product for lead (II) acetate.

Description – The lead (II) acetate is used to darken hair by reacting with the sulfur present in the hair color product and in the amino acids cysteine and methionine. These amino acids are incorporated into the protein structure of hair. The product of this reaction is black lead (II) sulfide. You will calculate the amount of lead (II) acetate present by measuring the amount of an insoluble lead (II) compound formed when a sample of the hair color product is reacted with potassium chromate.

This is a gravimetric procedure where an insoluble compound of lead will be formed and collected on filter paper. From the mass of the lead compound formed and the balanced formula equation the amount of lead (II) acetate present in the hair color product can be calculated. In the procedure the lead (II) acetate will be reacted with potassium chromate to form insoluble lead (II) chromate. All measurements and calculations made should be carried out to the proper number of significant digits.

Procedure

a. Measure out about 10 cc of hair color product. Be sure to record the exact volume used. The exact mass of the solution will also be needed. This will require the massing of the graduated cylinder both before and after the hair color product is placed into it.
b. Place the hair color product into a 150 mL beaker and add about 15 cc of 0.01 M potassium chromate solution. Warm the solution gently over a very low flame for about 2 minutes. Do not let the solution get above 50 degrees Celsius.
c. Mass out a piece of filter paper and filter the solution. Make sure that no yellow particles pass through the filter paper. If yellow particles pass through the filter paper re-filter the solution.
d. If the filtrate is not a clear yellow solution (this is different from a cloudy yellow which indicates that particles of lead (II) chromate are in the filtrate) add 10 mL more of 0.01 M potassium chromate solution to the filtrate. Heat the solution as you did in step 2 and filter using the same filter paper as in step 3. This is necessary because a clear colorless filtrate at this point indicates that all of the lead (II) acetate might not have reacted. A clear yellow filtrate at this point indicates that there is an excess of potassium chromate, therefore, all of the lead (II) acetate must have reacted.
e. Rinse the precipitate on the filter paper with 10 mL portions of distilled water until the filtrate is clear and colorless. A clear colorless filtrate is desired at this point to insure that all excess potassium chromate has been rinsed off the filter paper. Carefully open the filter paper and place it on a paper towel to dry overnight. Determine the mass of the filter paper when it is thoroughly dry. This is necessary to insure that all of the lead (II) acetate reacted. Repeat this step as often as necessary to insure that all of the lead (II) acetate reacted.

Results

1. Determine the density of the hair color product.
2. Determine the mass of precipitate produced and collected on the filter paper. The precipitate will be either lead (II) chromate if procedure I was used, or lead (II) iodide if procedure II was used.
3. Write the balanced equation for the reaction that took place based on the procedure you followed.
4. From the mass of the precipitate produced and the balanced equation for the reaction, determine the amount (in grams) of lead (II) acetate that must have been present in the sample of hair color product used.
5. Determine the percentage of lead acetate in the hair color product.
6. Determine the number of moles of lead acetate present in 1000 ml (1 liter) of the hair color solution.

Instructor Comments:
(http://chem.lapeer.org/Chem1Docs/LeadAnal.html)

The hair color solution I have the students analyze is Grecian Formula 16. The solution contains elemental sulfur which needs to be filtered off prior to the analysis.
I usually do this before the laboratory procedure and save the filter paper to show the students and explain why this filtration is necessary. After the first year I did this lab,
I wrote the company and asked if they would share with me the actual percentage of lead (II) acetate. They indicated in their response that the product contained between 0.29 and 0.34% lead (II) acetate by weight. Because of the small amount of lead (II) acetate present, a balance capable of massing to 0.001 grams is necessary. The profit margin calculation is very crude because it assumes that the only cost of production is the cost of the chemicals. However, it does serve to give students some insight into what profit margins are and how they are determined.

Final Note:
Because of the expense of Grecian Formula 16, I usually buy one bottle, filter off the sulfur, and combine it with a 0.32% lead acetate solution that I mix up in the lab. One bottle is purchased so that the solution to be analyzed will have the correct properties, namely odor.

HHM SESSION ONE QUIZ

Name: _____

IDENTIFYING HOUSEHOLD HAZARDOUS MATERIALS

1. Name the four primary categories of Hazardous Household Material.

_____ _____

_____ _____

2. Name four words of warning you'll likely find on the label on an HHM product.

_____ _____

_____ _____

3. Latex paint is not hazardous to the environment.
☐ True ☐ False

4. "Biodegradable" on a product label means it's not hazardous.
☐ True ☐ False

5. List three products used by cars that are Household Hazardous Materials.

_____ _____ _____

6. What are the three ways something that's toxic can cause injury or death?

_____ _____ _____

7. A chemical is officially considered corrosive if it can burn and destroy
_____ or _____ .

8. Flea collars are dangerous to more than fleas.
☐ True ☐ False

9. Virtually every home has Household Hazardous Materials stored in it.
☐ True ☐ False

10. If a chemical has been shown to cause cancer, it's considered a Household Hazardous Material.
☐ True ☐ False

HHM SESSION ONE QUIZ [INSTRUCTOR VERSION]

IDENTIFYING HOUSEHOLD HAZARDOUS MATERIALS

1. Name the four primary categories of Hazardous Household Material.

Flammable (or Combustible) *Explosive (or Reactive)*

Toxic *Corrosive*

2. Name four words of warning you'll likely find on the label on an HHM product.

Could be: Danger, Poison(ous), Warning, Explosive, Flammable, Corrosive, or Caution

3. Latex paint is not hazardous to the environment.

☒ True ☐ False

Only oil-based paints are considered hazardous to the environment (although latex paint does include chemicals hazardous to your health, they're not especially dangerous to the environment.) Latex paint can be safely discarded in the garbage if dry.

4. "Biodegradable" on a product label means it's not hazardous.

☐ True ☒ False

Biodegradable not only is not a government-sanctioned term, it has nothing directly to do with a product's danger to health.

5. List three products used by cars that are Household Hazardous Materials.

Could be: Oil, gas, antifreeze, transmission fluid, brake fluid, car wax, windshield wiper fluid, car detergent etc.

6. What are the three ways something that's toxic can cause injury or death?

Breathe it in *Absorb it through the skin* *Swallow it*

7. A chemical is officially considered corrosive if it can burn and destroy *Skin* or *Metal* .

8. Flea collars are dangerous to more than fleas.

☒ True ☐ False

They are considered a Household Hazardous Material.

9. Virtually every home has Household Hazardous Materials stored in it.

☒ True ☐ False

10. If a chemical has been shown to cause cancer, it's considered a Household Hazardous Material.

☒ True ☐ False

It's considered a "toxic" HHM.

HOUSEHOLD HAZARDOUS MATERIALS WORKSHEET

Name: _____

HOW MANY CAN YOU FIND IN YOUR HOUSE?

Directions: Parents, please review this list with your child, crossing off each HHM stored inside your home. Talk to your child about how you store these materials and how they are safely stored.

CAR PRODUCTS

Antifreeze
Batteries (lead acid)
Brake Fluid
Carburetor Cleaner
Car Wax
Engine Degreaser
Gasoline
Motor Oil
Transmission Fluid
Windshield Wiper Fluid

YARD SUPPLIES

Fertilizer
Insecticide
Weed Killer

HOUSEHOLD SUPPLIES

Aerosols
Air Freshener
Glue
Hair Color
Hair Spray
Nail Polish
Nail Polish Remover

CLEANERS

All-Purpose Cleaner
Ammonia
Bathroom Cleaner
Bleach
Carpet Cleaner
Disinfectant
Drain Cleaner
Floor Cleaner
Furniture Polish
Metal Polishes
Oven Cleaner
Paint Thinner
Scouring Powder
Spot Remover
Window/Glass Cleaner

MISCELLANEOUS

Asphalt/Roofing Tar
Batteries (NiCad-Rechargeable)
Batteries (DryCell – button)
Flea Sprays/Collars
Kerosene
Lighter Fluid
Mothballs
Paint (oil-based)
Photography Chemicals
Pool Chemicals
Rodent Killer

Others?

_____

_____

_____

_____

III. Classroom Session #2 - How Household Hazardous Materials Contaminate Groundwater

A Study of Groundwater

1. According to the DNR, 78.8% of Iowans get their drinking water from groundwater.
2. According to the U.S. Geological Survey, as of 1990 only six states relied more on groundwater as a drinking water source:
   a. Hawaii – 97.1%
   b. Mississippi - 90.2%
   c. Florida – 89.2%
   d. New Mexico – 87.0%
   e. Idaho - 81.4%
   f. Nebraska – 81.2
3. Nationwide, 41.9% of the population gets its drinking water from ground water - about15 billion gallons a day!
4. Supplies 75% of water used for livestock, irrigation, and commercial purposes.
5. Feeds lakes and streams, affecting their ecosystems.
6. In the United States, the volume of groundwater within 2,500 feet of the surface has been estimated at 100 quadrillion gallons (16 times the volume of the Great Lakes). At least half is too saline from natural causes to be used for drinking water. The EPA estimates 2-3% of the rest of the supply that is drinkable is contaminated by point sources.
7. In general, HHMs are rarely going to directly contaminate groundwater.
   a. Most often, they contaminate surface water and over time reach groundwater.
   b. The exception is drainage wells and topography with deep crevices.
8. Deeper aquifers have a higher rate of natural contamination from dissolved mineral content and radioactive materials. Shallow aquifers are more susceptible to man-made contamination.

9. Types of aquifers
    a. Alluvial Aquifers – These are saturated sand gravel deposits typically associated with larger streams. These supply the largest quantity and best natural quality water in the areas they exist. Due to shallow nature, however, they are susceptible to man-made contamination.
    b. Buried Channel Aquifers – These are deeper sand and gravel deposits associated with ancient streams. These do exist at numerous locations in Iowa, and where accessible they tend to yield good quality water. Because they are deeper, they are less susceptible to man-made contamination.
    c. Bedrock Aquifers – The upper-most bedrock in roughly the northeastern half of Iowa provides a reliable source of good quality water. It consists of sandstone and fractured limestone and dolomite formations. In areas where the overlying soil is thin, or where sinkholes exist (north-central and far northeastern parts of the state), these aquifers are susceptible to contamination, especially from agricultural fertilizers and pesticides.

        Iowa's bedrock aquifers include the Dakota sandstone aquifer, located mostly in northwestern Iowa, which is high in dissolved minerals; the Cambrian-Ordovician Aquifer (which includes the commonly known Jordan Aquifer), a deep bedrock aquifer that is available all across the state except the northwestern corner). Its value is limited because of high dissolved mineral levels in the western third of the state and its depth (at least 2,000 feet underground) in the southwestern part of the state.
    d. Glacial Drift Aquifers – These aquifers, which are located across most of the state, were created by glaciers and consist of silty clay materials with occasional pockets of sand and gravel. They tend to have low to moderate yields and mostly are used for small, private water supplies when a better aquifer is not available. The natural water quality is usually good, but they are shallow and thus susceptible to localized contamination.

10. While the U.S. has large amounts of potable water available for use, local concentrations of toxic metals, organic chemicals and petroleum products form localized problems.
11. Large regions have been identified in which contaminants, derived from nonpoint sources and often at undetectable levels, are present in many shallow wells in a given area. Such nonpoint source contamination is associated with densely populated urban areas, agricultural land uses, and concentrations of septic systems.

B. Which Household Hazardous Materials discussed in Session #1 are most likely to reach the groundwater system and end up in "the wrong package"?

1. Fluids (oil, antifreeze, pesticides, detergents, paint, etc.)
2. Fertilizer (applied directly to ground and flushed by rain)

C. How do HHM reach groundwater?

1. Point Sources (localized in an acre or less)
   a. Feed lots
   b. Industrial sites
   c. Landfills
2. Nonpoint Sources (Sources dispersed over broad area) – EPA Definition: "NPS pollution is caused by rainfall or snowmelt, moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water.
   a. Household drains
   b. Farm fields
   c. Storm sewers
   d. General ground contamination
3. What happens…
   a. to hazardous materials that are poured down the drain?
   b. to hazardous materials poured on the ground?
   c. to hazardous materials poured in the storm sewer?
   d. to hazardous materials improperly placed in garbage collection?

D. Suggested Illustration/Demonstration: Ask City Engineering representative to attend class or provide materials to explain where local drinking water supply originates, as well as how the sewage treatment and storm sewer systems operate. Look for specifics, such as where the storm sewers empty. Some communities do process storm sewer drainage (making them vulnerable to water flow that exceed treatment capacity during heavy storms, and causing raw sewage to be released into the waterway). Most do not, with their storm sewer systems merely channeling water back into the environment without treatment, causing direct surface water contamination.

E. Additional Research

The organic substances most frequently reported in groundwater as resulting from waste disposal include (in decreasing order of occurrence) tricloroethylene (TCE), chloroform, benzene, pentachlorophenol, tetrachloroethylene (PCE), creosote, phenolic compounds, 1,1,1-trichloroethane, toluene, and xylene. Have students research what these chemicals are, what they do, and where they are found.

F. Exercises

1. Waterflow Demonstration

Objective – Students will gain an awareness of how water supplies can be contaminated through neighborhood runoffs.
Materials – Water; wax paper; tape; food coloring; salt; oil; clay; pepper; sugar; "other pollutants;" eyedropper.
Procedure – Using small groups of 3-5 students, cover cardboard piece with wax paper and use the clay to form a maze with one starting point and two exit points (one labeled "treatment plant" and one "stream." Let the clay dry for one day. Have students list things that can enter a street gutter inadvertently or on purpose and can be carried by the water flow. Place drops of food coloring and salt water mixed with pepper, and oil on different locations within the maze.

Allow one day for the water to evaporate, then tilt the maze and add a drop of water at the starting point, letting it drop slowly to an exit. Examine the contaminants it collects along the way. Drops that exit to the "treatment plant" are replaced with a fresh drop. Drops that return to the water supply untreated should be collected in a glass jar to examine the pollutants.

2. Aquifer Sundae (*www.groundwater.org*)

Objective – To demonstrate for students about geological formations in an aquifer and how contaminants can enter the water system and filter down into the water table.
Materials – Blue or red food coloring; vanilla ice cream; clear soda pop; crushed ice; variety of colored sprinkles and sugars; drinking straws; clear plastic cups.
Procedure – The instructor should fill a clear plastic cup 1/3 full with crushed ice (representing underground gravel and soil). To represent the water in the aquifer, add just enough soda to cover the ice. Add a layer of ice cream to serve as the geologic "confining layer" that lies above the aquifer. Then add more crushed ice to represent upper soil.

Cover top with colored sugars and sprinkles to represent top soil, creating a porous surface. Add food coloring to the soda and pour it on top of the "aquifer." Observe what happens when the "contamination" is added to the environment. Then using a straw, "drill" a well by sucking on the straw – watch how the water table lowers and how contamination gets sucked into the well area and ultimately reaches the groundwater. Recharge the aquifer by adding more rainfall (soda).

While the aquifer can then be eaten, care should be taken to avoid the message that "contaminated water" can be safely consumed. It's recommended that only the teacher do the activity as a demonstration, making a point of discarding the "contaminated" and spoiled aquifer. The students may then be encouraged to share the leftover ingredients.

3. Storm Sewer Stencils

The class can be encouraged to join other organizations around the country volunteering to paint signs at entry points to storm sewers that empty direction into surface water. They use stencils that show the image of a fish and the words, "Dump No Waste. Drains To Stream." For further information on Storm Sewer Stencils log on to www.earthwater-stencils.com. or www.ciwmb.ca.gov/UsedOil/Grants/Resources/Vendors/Stencils.doc.
Be sure to first secure permission from community officials!

HHM SESSION TWO QUIZ

Name: _____

HOW HOUSEHOLD HAZARDOUS MATERIALS CONTAMINATE GROUNDWATER

1. Why is Iowa more reliant on groundwater as a source for drinking water than almost all other states?

2. Why might Hawaii and Florida be even more dependent on groundwater than Iowa?

3. In general, will HHMs affect groundwater or surface water first? Why?

4. Identify the four primary types of aquifers and what differentiates them:
   a.
   b.
   c.
   d.

5. Discuss a scenario in which a HHM is improperly disposed of and how it might ultimately reach an underground water source.

6. Buried Channel aquifers generally have the best-quality water because they're more protected from man-made contamination.
   ☐ True ☐ False

7. Explain the difference between Point Sources of groundwater pollution and Nonpoint Sources of groundwater pollution. Why could a storm sewer be considered either?

8. An underground water supply in an urban city area is more likely to be contaminated by Point Source contamination or Nonpoint Source contamination?

9. Since storm sewers lead to water treatment plants, any hazardous chemicals that are washed into the sewers by rain will be safely treated before re-entering the groundwater system.
   ☐ True ☐ False

10. All contamination of underground water originates with people.
    ☐ True ☐ False

HHM SESSION TWO QUIZ [INSTRUCTOR VERSION]

HOW HOUSEHOLD HAZARDOUS MATERIALS CONTAMINATE GROUNDWATER

1. Why is Iowa more reliant on groundwater as a source for drinking water than almost all other states?
   Because surface water sources are limited in Iowa. Relatively, we don't have a lot of lakes.

2. Why might Hawaii and Florida be even more dependent on groundwater than Iowa?
   Because while surrounded by water, that water is ocean water and too saline to be used for drinking water.

3. In general, will HHMs affect groundwater or surface water first? Why?
   Surface water. Because most HHM contamination is caused when rain washes the chemicals into rivers, lakes, ponds, etc.

4. Identify the four primary types of aquifers and what differentiates them:
   a. *Alluvial – Saturated sand deposits, but shallow.*
   b. *Buried Channel – Deep sand & gravel deposits*
   c. *Bedrock – Sandstone and fractured limestone, often deep underground*
   d. *Glacial Drift – Created by glaciers, consisting of silty clay & sand and gravel pockets*

5. Discuss a scenario in which a HHM is improperly disposed of and how it might ultimately reach an underground water source.
   Answers vary, but should include means of entry, how it would be transported, and how it might reach an aquifer.

6. Buried Channel aquifers generally have the best-quality water because they're more protected from man-made contamination.
   ☒ True ☐ False

7. Explain the difference between Point Sources of groundwater pollution and Nonpoint Sources of groundwater pollution. Why could a storm sewer be considered either?
   Point sources are large sources that originate from a single identifiable location, including a landfill, a farm feed lot, or a factory. Nonpoint sources don't come from a single identifiable source. Rather, they accumulate from many different sources (chemicals flushed down the drains at different houses in different neighborhoods or farm fields, or poured onto the ground in different areas). A storm sewer system could be defined either way because it collects water from many different sources, but it drains the outflow at a single point.

HHM SESSION TWO QUIZ [INSTRUCTOR VERSION]

HOW HOUSEHOLD HAZARDOUS MATERIALS CONTAMINATE GROUNDWATER

8. An underground water supply in an urban city area is more likely to be contaminated by Point Source contamination or Nonpoint Source contamination?
Nonpoint Source, because there is a higher concentration of people to serve as contamination sources.

9. Since storm sewers lead to water treatment plants, any hazardous chemicals that are washed into the sewers by rain will be safely treated before re-entering the groundwater system.
☐ True ☒ False
Most storm sewers empty directly into the surface water system (rivers, lakes, and streams) and do not go to a water treatment plant. Besides, a water treatment plant may not be able to filter out a particular hazardous chemical.

10. All contamination of underground water originates with people.
☐ True ☒ False
Contamination can also occur from natural sources, including salt and minerals

G. Other IDNR Resources

Your nearest office of the Iowa Department of Natural Resources may have models of aquifers and the water system available for loan and demonstration to classrooms. Please contact the IDNR for more information on how they can help. Also, check with the Soil and Water Conservation District office and the County Conservation Board.

IV. Classroom Session #3 – Proper Handling & Disposal of Household Hazardous Material

A. General Rules

1. Keep HHM containers dry and away from extreme heat and cold.
2. Keep where children and pets cannot reach them.
3. Keep in original or labeled containers.
4. Store in upright positions.
5. Don't mix chemicals together.
6. Buy only what you need, and use what you buy.
7. What you can't use, try to give to someone who can. Note: (It is unlawful to give a container of pesticide to someone else if it has been opened or if its label is missing or cannot be easily read).
8. NEVER pour waste fluids into storm drains, sewers, on the ground, septic systems, or in the garbage.

B. IDNR Waste Management Assistance

1. Central Office – Mission Statement: "To educate and assist Iowans to protect, conserve and enhance natural resources and the environment for all generations through the sustainable practices of pollution prevention and responsible waste management."

2. Regional Collection Centers – There are permanent, year-round sites for collection of household hazardous materials now serving many Iowa counties. All operate with funding and technical assistance from the Waste Management Assistance staff. The department's goal is to have a regional collection center available for each Iowa county. *(See IDNR Web site for locations and contact information:* www.safesmartsolutions.org

C. Paints and Solvents

1. Paint – According to the National Paint & Coatings Association, 29% of consumers said they have unwanted leftover paint stored in their homes. Paint constitutes 40-70% of the HHM collected by local collection centers (although most is technically not a HHM).
   a. Oil-based: Call Your Regional Collection Center
   b. Latex (water-based). While chemicals inside latex paint are toxic and hazardous if swallowed (most contain volatile organic compounds), latex paint is not considered a Hazardous Household Material. There is, however, a proper way to dispose of it:
      i. Don't pour down drain
      ii. If DRY, can be safely put in trash
      ii. If it's not already dry, leave lid off can. If there's too much left to dry without help, spread paint in a newspaper-lined cardboard box and let it dry a layer at a time. Then dispose of newspapers in the regular trash. It can be mixed with kitty litter to thicken for easier disposal.
2. Solvents/Paint Thinner (Flammable)
   a. Store in closed jar until particles settle.
   b. Strain off clear liquid that remains and reuse.
   c. Dry remaining sludge, wrap in plastic, and discard in trash.
3. Rust remover/turpentine/furniture stripper (Flammable)
   a. Call Regional Collection Center.

D. Cleaners

1. Drain Openers/Kitchen-Bathroom Cleaners/Bleach (Corrosive/Toxic)
   a. Best option: Use as directed.
   b. Second best: Give away to someone to use as directed.
   c. To discard: Some cleansers can be poured down a drain. *If you have a septic tank*, drain disposal should nearly always be avoided (chemicals kill bacteria that's needed for septic systems to work). If cleansers are designed to be used with water in a home or in sinks, showers, toilet bowls, and tubs, the material is probably drain disposable. Let the water run, rinse the container and slowly pour the water/chemical down the drain. Allow the water to continue running after the chemical is gone. Allow the container to air dry (or swab with paper towels), and dispose in household refuse.

2. Furniture Polish; spot removers (Flammable)
   a. Use.
   b. Give away.
   c. Call Regional Collection Center.

E. Exercises

1. Math: Paint Job

Objective – Teach how to effectively calculate appropriate quantity of paint to buy, demonstrating that the best step to eliminate wasted paint is to buy the correct amount in the first place.

Materials – Pencil, paper, calculator.

Procedure - Divide class into groups. Figure out how many gallons of paint are needed to cover the walls of an 18 x 30 foot room with 8-foot ceilings if one gallon covers 300 square feet of wall. There are four windows, each measuring 2 x 4 feet, and one doorway 3 feet wide and 7 feet high. The salesman recommends that you apply two coats. Approximately how much paint will be left over from the last can? What should you do with what's left over? Did all groups come up with the same answer?

Solution: The wall surface would measure 715 square feet. At 300 square feet per gallon, each coat would require 2.384 gallons, or 4.767 gallons for two coats, leaving .232 gallons in the last can (or about a quarter of a gallon). The leftover paint should be stored for future touchups, or given to someone else who can use it.

2. The Dilution Solution (source: EPA)

   Objective – To show that dilution is not a good solution to surface water pollution.

   Materials – 1 empty aquarium or other large clear container; two 500-ml beakers or glass jars; tap water; red food coloring.

   Background – The water in surface water bodies, such as lakes and oceans, is replenished over time by being fed through rivers, rainfall, etc. The amount of time it takes for a body of water to completely change is called the "retention time" (also "renewal time" and "flush rate"). The amount of time varies with the body of water. Lake Erie has a retention time of 9 years. For Lake Superior, it's 200 years. However, that doesn't mean that all existing pollution is washed away in that same amount of time.

   Procedure – Fill a beaker or jar with tap water and stir in a few drops of food color, turning the water bright red. The red represents a pollutant in a medium-sized Midwestern lake. Ask students how long they think the retention time would be for the lake. Try one complete renewal of the water by filling the second beaker with clear tap water. With a student holding the "lake" with red water over an aquarium, pour this new water into the "lake." The water will mix and overflow into the aquarium. Observe that while all the water has been "replaced," the pollutant is still visible.

   Repeat several times until the "lake" water is again clear, and multiply the number of times it took by the 3-to-10 years retention time for a medium-sized lake in the Midwest. The result is how long it would take for all the pollutants to clear from the hypothetical lake (assuming no more pollutants are introduced). Don't forget the water in the aquarium. Note that it's red – the pollution didn't disappear; it merely moved to another water source!

HHM SESSION THREE QUIZ

Name: _____

PROPER HANDLING AND DISPOSAL OF HHM, PART 1

1. List 5 rules for properly storing Household Hazardous Materials:

_____ _____ _____

_____ _____

2. What is an "RCC" and what does it do?

3. What's the name and location of your nearest RCC?

4. The single most common item collected by government hazardous material handling programs is _____.

5. From an environmental standpoint, the best commonly-found paint to use is _____ paint.

6. Paint thinner is highly toxic and flammable, and definitely a Household Hazardous Material. Rather than disposing of it, it can be reused. How?

7. The best way to dispose of highly flammable products like spot removers, rust removers, and furniture strippers is to use them as directed. Otherwise, it's best to:
   a. flush down the drain.
   b. call your RCC.
   c. let dry and put in the garbage.
   d. pour on ground.

8. What state agency is responsible for protecting the quality of Iowa's water sources?

9. Name the different factors that go into deciding how much paint to buy.

10. The state tells us we should be careful not to let Household Hazardous Materials end up in "the wrong package." What does that mean?

HHM SESSION THREE QUIZ [INSTRUCTOR VERSION]

PROPER HANDLING AND DISPOSAL OF HHM, PART 1

1. List 5 rules for properly storing Household Hazardous Materials:

Keep HHM containers dry and away from extreme heat and cold.

Keep where children and pets cannot reach them.

Keep in original or labeled containers.

Store in upright positions.

Don't mix chemicals together.

Buy only what you need, and use what you buy.

2. What is an "RCC" and what does it do?
An RCC — Regional Collection Center — is independently owned and operated under state supervision. It is responsible for the collection and proper disposal of Hazardous Materials. The Iowa DNR's goal is to eventually have each county served by an RCC.

3. What's the name and location of your nearest RCC?
Consult www.safesmartsolutions.org for complete list.

4. The single most common item collected by government hazardous material handling programs is *paint.*

5. From an environmental standpoint, the best commonly-found paint to use is *latex* paint.

6. Paint thinner is highly toxic and flammable, and definitely a Household Hazardous Chemical. Rather than disposing of it, it can be reused. How?
Store in closed jar until particles settle. Strain off clear liquid that remains and reuse. Dry remaining sludge, wrap in plastic, and discard in trash.

7. The best way to dispose of highly flammable products like spot removers, rust removers, and furniture strippers is to use them as directed. Otherwise, it's best to:
a. flush down the drain.
b. call your RCC.
c. let dry and put in the garbage.
d. pour on ground.

8. What state agency is responsible for protecting the quality of Iowa's water sources?
Iowa Department of Natural Resources

9. Name the different factors that go into deciding how much paint to buy.
How many coats are needed; height and length of the walls; size of windows, doors, and other non-wall spaces; how much wall area a gallon of that type of paint covers.

10. The state tells us we should be careful not to let Household Hazardous Materials end up in "the wrong package." What does that mean?
The "wrong package" is us — the people of Iowa. Those dangerous chemicals you read on package labels could end up in us if not properly disposed of.

V. Classroom Session #4 – Proper Handling & Disposal of Household Hazardous Material, Part 2

A. Automotive/Engine Products

1. Used Motor Oil (Flammable)
   a. 5% of do-it-yourselfers dump old oil on ground; another 3% put in trash
      (From a survey of 220 Iowa households conducted in Nov., 2000).
   b. Used oil contains toxins, including lead, napthalene, & chlorinated hydrocarbons.
   c. Store in clean plastic jug (it's important not to mix it with other chemicals)
   d. Take to authorized retailer for recycling
   e. What happens to recycled oil? *(American Petroleum Institute)*
      i. Transporters collect it in tanker trucks by vacuuming it from the storage containers. It's then tested for hazardous components before being mixed in a holding tank, and eventually it's delivered to re-refiners, processors, or sites that burn the oil for fuel.
      ii. Reprocessing is the most common method of recycling used motor oil in the US (75% of all recycled oil). Of that (all numbers are national figures):
         - 43% goes to asphalt plants
         - 14% to industrial boilers (factories)
         - 12% to utilities for power generation;
         - 12% to steel mills
         - 5% to cement/lime kilns
         - 5% is blended to make marine fuels
         - 4% to pulp & paper mills
         - >1% to commercial boilers (to heat schools, offices, etc.)
         - 5% to others.
      iii. 14% of recycled oil is turned over to re-refiners who clean and treat it to return it to its original virgin oil state (motor oil does not wear out; it just gets dirty).

iv. 11% of used motor oil is used in specially designed space heaters in automotive bays and municipal garages (not recommended for home use). The estimated 75,000 heaters across the nation use about 113 million gallons of used oil per year, saving heating costs.

2. Antifreeze – Ethylene Glycol (Poisonous)
   a. Contact IDNR or RCC for recycling information.
3. Gasoline (Poisonous/Flammable/Explosive)
   a. If stored for a long time, use a stabilizing additive
   b. If gas is unusable, call your Regional Collection Center or IDNR
4. Car Batteries (Corrosive)
   a. Retailers accept old batteries for recycling when a new one is purchased.
   b. If not buying a new battery, call IDNR for a list of collection sites or contact a retailer. Many will collect batteries even without purchase.
5. Car Wax/Detergents (Poisonous)
   a. Best to wash car at commercial car wash ((which redirects it to a waste water treatment plant).
   b. Don't wash in driveway or street where detergent reaches storm sewer.
   c. Instead, wash over gravel or grass to naturally filter some contaminants.
6. Other Fluids (windshield wiper fluid; brake fluid; transmission fluid). Contact your Regional Collection Center or the IDNR for disposal.

B. Pesticides/Herbicides/Fertilizers

1. Weed killer; insecticides; flea-roach powder; rat/mouse poison; mothballs (Poisonous); flea collars
   a. Don't pour onto ground, bury, dump in sewer, or flush.
   b. Don't use pesticides when rain is forecast (rain will wash directly into water system).
   c. Only use as intended and directed. Note: It is unlawful to give a container of pesticide to someone else if it has been opened or if its label is missing or cannot be easily read.
   d. Empty plastic liquid containers should be rinsed out 3 times and recycled. Pesticide rinse water can be reused as more pesticide.
   e. Solids and spray cans – mothballs, flea collars, insecticide cans – should be used as directed or handled by Regional Collection Center.
2. Wood preservatives (Poisonous/Flammable). Contact your Regional Collection Center or the IDNR.

C. Exercises

1. *Keeping A Green Car* – Have students (novice drivers) identify all the environment impact factors involved in automobile ownership and what the owner's environmental responsibilities are: recycling used oil and other fluids; recycling batteries; keeping car engine tuned to enhance mileage and reduce emissions; tire disposal; washing the car; fixing oil leaks.

2. Surveys
   Oil Recycling Survey - Millions of gallons of used motor oil is drained from car engines across Iowa each year, much of it by do-it-yourselfers. Survey students to see if they know whether their parents have a mechanic change their cars' oil or whether their dad or mom do it. Compare the numbers. Do any older students change their own oil? Can they recount what happened when they took in the used oil for disposal? What about oil filters, which are changed when the oil is changed. They contain oil even after being properly drained?

Recycling Center Survey – Contact the IDNR at www.safesmartsolutions.com for used oil and used oil filter collection sites. Recycling Center Survey - Have students visit different automotive service centers (include a representative range, from small service stations to large car dealerships) to see how many recycle oil, and investigate how it's collected and saved. Be sure to call ahead for appointment. Ask about procedures, regulations, how the state enforces the rules, and how things overall have changed in the past 20 years.

3. *Classroom Discussion* - Compare results found within different families and oil collection sites. Talk about the economic implications of not recycling used motor oil (recycling 23 million gallons of used motor oil would save about half a million barrels of crude oil a year).

   Note: The IDNR Web site offers an Auto Directory guide to help you properly dispose of lead-acid batteries and antifreeze as well as used oil and filters. The guide also contains related references and other information.

HHM SESSION FOUR QUIZ

Name: _____

PROPER HANDLING AND DISPOSAL OF HHM, PART 2

1. According to an Iowa DNR study, about what percentage of people who change the oil in their own car dispose of it improperly?

2. Who collects used motor oil from do-it-yourself oil changes? What do they do with it?

3. The largest user of recycled motor oil is _____.

4. More than 113 million gallons of used motor oil is burned in special space heaters in automotive bays and municipal garages. What percentage is this of all oil turned in for recycling?

5. What car part (not a fluid) that's considered a Household Hazardous Material is commonly recycled?

6. From an environmental perspective, what's the best place to wash a car? Why?

7. Why is it a bad idea to wash a car in your driveway?

8. It's illegal to change your own car oil.
   ☐ True ☐ False

9. Is it better to fertilize a lawn or apply pest and/or weedkiller when the forecast is for sunshine, or when rain is expected? Why?

10. List three environmental responsibilities that car owners have:

HHM SESSION FOUR QUIZ [INSTRUCTOR VERSION]

PROPER HANDLING AND DISPOSAL OF HHM, PART 2

1. According to an Iowa DNR study, about what percentage of people who change the oil in their own car dispose of it improperly?
   At least 8%.

2. Who collects used motor oil from do-it-yourself oil changes? What do they do with it?
   It's collected by most service stations and car dealerships with service departments. They store it until it can be collected and transported to reprocessing facilities.

3. The largest user of recycled motor oil is *asphalt plants.*

4. More than 113 million gallons of used motor oil is burned in special space heaters in automotive bays and municipal garages. What percentage is this of all oil turned in for recycling?
   11%.

5. What car part (not a fluid) that's considered a Household Hazardous Material is commonly recycled?
   Battery

6. From an environmental perspective, what's the best place to wash a car? Why?
   Commercial car washes. Because the water is directed to the waste water treatment plant.

7. Why is it a bad idea to wash a car in your driveway?
   The detergents are washed down the driveway into the street, where they enter the storm sewer system, which probably drains right into the natural water system.

8. It's illegal to change your own car oil.
   ☐ True ☒ False
   It's just illegal to improperly dispose of the used oil.

9. Is it better to fertilize a lawn or apply pest and/or weedkiller when the forecast is for sunshine, or when rain is expected? Why?
   When the forecast is clear. Rain will wash the fertilizer into the water system before it can be absorbed.

10. List three environmental responsibilities that car owners have:
    Properly dispose of used motor oil, antifreeze, and other fluids; fix oil leaks, recycle batteries; keep car tuned and tires inflated to improve gas mileage; wash the car responsibly; properly dispose of products like car detergents & waxes.

VI. Classroom Session #5 – Alternatives to Household Hazardous Materials

A. Buy Smart
   1. Only Buy What You Need
   2. Buy Better Products
      a. For example, buy latex instead of oil-based paint
         i. It's disposable (when dry)
         ii. Water – not turpentine or thinner – are all that's needed for cleanup (avoiding the creation of another HHM disposal problem).
      b. And use traps rather than poison for mice and other pests (makes little difference to the mouse).

B. Safer Choices

1. Instead of **household plant insecticide**, use spray mixture of bar soap & water on leaves, then rinse.
2. Instead of **mothballs**, try cedar chips or newspapers.
3. For a household **all-purpose cleaner**, mix 1/2 cup ammonia, 1/2 cup white vinegar, 1/2 gallon of water, and 1/4 cup of soda.
4. Instead of **toilet cleaner**, use brush and baking soda or mild detergent; or a paste of borax and lemon juice.
5. Instead of **cleaners,** use 1/2 cup borax mixed with 1 gallon of water (borax is caustic; use with latex gloves).
6. Instead of **drain cleaner**, try a plumber's "snake," or pour 1/2 cup of baking soda and 1/2 cup of vinegar into drain and cover (allowing the gas that's created to clear the drain).
7. Instead of **laundry bleach**, try 1/2 cup white vinegar, or baking soda, or borax, or 3% hydrogen peroxide solution.
8. Instead of **ammonia-based cleaners**, try a vinegar, salt, and water mix.
9. Instead of **bathroom cleaners**, try a baking soda and water mixture.
10. Instead of **abrasive cleaners/powders**, rub areas with 1/2 lemon dipped in borax; rinse(be sure to wear rubber gloves!).
11. Instead of **floor/furniture polish**, mix 1 part lemon juice with 2 parts olive or vegetable oil.
12. Instead of **carpet cleaner**, use a mix of corn meal and borax…
13. …or try just sprinkling baking soda on carpet.

14. Instead of **garden bug spray**, try mixing 1 part crushed hot peppers with 4 parts water. Strain and spray on plants (be careful to avoid eyes).
15. For **ants**, sprinkle cream of tartar, red chili powder, or dried peppermint where they enter.
16. For **roaches and silverfish**, use equal parts baking soda and powdered sugar.
17. Instead of **spot removers**, use 1/4 cup borax in 2 cups cold water to presoak.
18. Instead of **kitchen degreaser**, use baking soda or nonchlorinated scouring powder with abrasive pad or steel wool.
19. Instead of **vinyl floor cleaner**, use 1/2 cup vinegar in 1 gallon of water.
20. Instead of **vinyl floor polish**, use club soda.
21. Instead of **wood floor polish**, damp mop with mild vegetable oil soap.
22. Instead of **air freshener**, use open box of baking soda in refrigerators, closets, & bathrooms.
23. Instead of petroleum-based **wood stains & finishes**, use natural sources such as shellac, tung oil, and linseed oil.
24. Instead of **metal polish**, combine 1 tsp. Baking soda, 1 qt. Hot water, and 1 piece of aluminum.
25. Instead of **copper cleaner**, make a paste of equal parts vinegar, salt, and flour (rinse thoroughly afterward to prevent corrosion), or lemon juice and salt.
26. Instead of **brass polish**, use Worcestershire sauce.
27. Instead of chemical **fertilizer** for gardens, use organic (manure).
28. Instead of chemical **fabric softener**, add 1/4 to 1/2 cup of baking soda per wash load.
29. Instead of chemical **paint brush softener**, soak brush in warm vinegar for 1/2 hour.
30. To remove **rusty bolt/nut**, pour a carbonated beverage on it.
31. For **leather shoes,** apply olive oil, walnut oil, or beeswax to shoes then buff with a chamois cloth.
32. To clean **leather,** rub equal parts of white vinegar and linseed oil into leather; buff with soft cloth.
33. To shine and protect **patent leather shoes**, rub with a dab of petroleum jelly.
34. To clean dirt marks from **suede**, rub with an art-gum eraser and buff lightly with sandpaper, an emery board or a wire suede brush.

C. Exercise

Baking Soda as a safe alternative

Objective – To demonstrate how common baking soda can be an effective odor-killer, and is much safer than room "air fresheners." While air fresheners are not particularly a hazard to water sources, they are classified a Household Hazardous Material in the home because of their toxicity.

Materials – Several clean small wide-mouth jars with lids (such as baby food jars), liquid odor sources (possibilities include vinegar, lemon juice, pickle juice, vanilla extract, sauerkraut juice, and water from canned tuna), cotton balls, one box of baking soda.

Procedure – Divide class into small groups and give each two or three jars. In each jar, put a cotton ball, followed by two to three drops of an odor source. Have students close the jar and shake it several times, then let it sit for at least 2 minutes. Open jars and have students smell the odor and describe it. Then place a teaspoon of baking soda into each jar along with the cotton ball. Close jar again and shake several times, again letting it sit for 2 minutes, but with the lid loosely on (allowing gas to escape and preventing pressure
build-up). Open the jar and compare the odor to the original.

Since many odors are caused by acids, and baking soda neutralizes acids through chemical reaction (releasing carbon dioxide in the process), new substances are formed that have different or less obvious odors. Some odors are not caused by acids; they will not be as affected by the baking soda. Students can also be asked to measure relative pH balance of the odor source liquids with litmus or indicator paper.

HHM SESSION FIVE QUIZ

Name: _____

ALTERNATIVES TO HOUSEHOLD HAZARDOUS MATERIALS

1. The best way to handle Household Hazardous Waste is to “buy smart.” What does that mean?

2. When you’re done eating your steak, you can use the leftover Worcestershire sauce to _____.

3. Roaches and silverfish are in for a nasty surprise when you mix baking soda with _____.

4. Instead of “scrubbing bubbles,” you can clean your bathroom fixtures with a paste made of _____ and water.

5. You can also clean your toilet with a paste made of _____ and some fruity _____.

6. No need for that can of floor or furniture polish that uses a petroleum oil base. Instead, try mixing one part _____ juice with two parts _____ or _____ oil.

7. If you love your carpet when it smells fresh, just sprinkle a little _____ on it and vacuum. Or you can freshen your carpet with a mix of corn meal and _____.

8. Why use nasty chemicals on your vinyl floor when you can just mix half a cup of _____ with a gallon of water?

9. You’ll bring tears to the eyes of wandering ants by sprinkling a little _____ powder at the point where they are coming into your home.

10. Sometimes the air gets not-very-fresh in your home. Instead of using an air freshener that works by deadening the nerves in your nose, try opening a box of _____.

11. To keep bugs off your garden plants, instead of using poison try a spray of 1 part crushed _____ with 4 parts _____. Or you can introduce your garden to beneficial _____.

HHM SESSION FIVE QUIZ

ALTERNATIVES TO HOUSEHOLD HAZARDOUS MATERIALS

12. Can't loosen a rusty bolt or nut? Instead of using a petroleum oil-based solvent, try pouring a little _____ on it first (without thinking about what it does to your stomach when used normally).

13. Water won't go through the bathtub drain? Instead of pouring strong chemicals right into the sewer system or your septic tank, try pouring some try pouring _____ and cover tightly.

14. You can still snuggle up to your laundry without using a chemical fabric softener. Try adding 1/4 to 1/2 a cup of _____ instead.

15. Instead of using chemicals, fertilize your lawn the natural way by using _____.

HHM SESSION FIVE QUIZ [INSTRUCTOR VERSION]

ALTERNATIVES TO HOUSEHOLD HAZARDOUS MATERIALS

1. The best way to handle Household Hazardous Waste is to "buy smart." What does that mean? *Buy only what you need, and use what you buy. Buy the most environmentally-friendly products that you can (such as latex paint instead of oil-based).*

2. When you're done eating your steak, you can use the leftover Worcestershire sauce to *polish brass*.

3. Roaches and silverfish are in for a nasty surprise when you mix baking soda with *powdered sugar*.

4. Instead of "scrubbing bubbles," you can clean your bathroom fixtures with a paste made of *baking soda* and water.

5. You can also clean your toilet with a paste made of *borax* and some fruity *lemon juice.*

6. No need for that can of floor or furniture polish that uses a petroleum oil base. Instead, try mixing one part *lemon* juice with two parts *olive* or *vegetable* oil.

7. If you love your carpet when it smells fresh, just sprinkle a little *baking soda* on it and vacuum. Or you can freshen your carpet with a mix of corn meal and *borax.*

8. Why use nasty chemicals on your vinyl floor when you can just mix half a cup of *vinegar* with a gallon of water?

9. You'll bring tears to the eyes of wandering ants by sprinkling a little *red chili* powder at the point where they are coming into your home.

10. Sometimes the air gets not-very-fresh in your home. Instead of using an air freshener that works by deadening the nerves in your nose, try opening a box of *baking soda.*

11. To keep bugs off your garden plants, instead of using poison try a spray of 1 part crushed *hot peppers* with 4 parts *water.* Or you can introduce your garden to beneficial *bugs (such as lady bugs or praying mantes).*

HHM SESSION FIVE QUIZ [INSTRUCTOR VERSION]

ALTERNATIVES TO HOUSEHOLD HAZARDOUS MATERIALS

12. Can't loosen a rusty bolt or nut? Instead of using a petroleum oil-based solvent, try pouring a little *carbonated beverage* on it first (without thinking about what it does to your stomach when used normally).

13. Water won't go through the bathtub drain? Instead of pouring strong chemicals right into the sewer system or your septic tank, try pouring *in 1/2 cup baking soda, then 1/2 cup vinegar* and cover tightly.

14. You can still snuggle up to your laundry without using a chemical fabric softener. Try adding 1/4 to 1/2 a cup of *baking soda* instead.

15. Instead of using chemicals, fertilize your lawn the natural way by using manure.

VII. Project Summary

A. Review

1. What makes some household materials hazardous?
2. How can you identify Household Hazardous Materials?
3. What are some general rules about buying, storing, and disposing of HHM?

B. Discuss:

1. The IDNR Slogan: Safe, Smart, Solutions for Iowa
2. What does the IDNR mean when it says we shouldn't let HHM end up in "the wrong package"?

C. Iowa DNR Web site review

D. How students can continue to help

1. Exhibit care in using and disposing of HHMs
2. Make safe buying decisions
3. Educate others

E. Exercise

Break class into small groups to discuss and outline plans society should use to approach the problem of Household Hazardous Materials. Are there laws that can be created? How would they be enforced? What kinds of public relations campaigns would reach the appropriate audience? What would be an effective message? Have each group prepare a presentation of a public relations/advertising message that would convince consumers how to carefully handle and dispose of hazardous household materials.

HHM SESSION REVIEW QUIZ

Name: _____

WRITE DEFINITIONS FOR THESE TERMS.

1. Leachate

2. Toxic

3. Caustic

4. Aquifer

5. Groundwater

6. Nonpoint Source Pollution

7. Point Source Pollution

8. RCC

9. HHM

HHM SESSION REVIEW QUIZ [INSTRUCTOR VERSION]

Name: _____

WRITE DEFINITIONS FOR THESE TERMS.

1. Leachate - *seepage from garbage landfills into the ground below*

2. Toxic - *poisonous; substance that causes illness, injury, or death*

3. Caustic - *erodes metal or skin*

4. Aquifer - *underground geological formation in which rocks, gravel, or sand is filled with water*

5. Groundwater - *the water that flows through aquifers*

6. Nonpoint Source Pollution - *contamination that originates from a variety of widespread sources*

7. Point Source Pollution – *contamination that originates from an unidentifiable point or pipe*

8. RCC - *Regional Collection Center; a facility for collecting and disposing of hazardous materials*

9. HHM - *Household Hazardous Material*

SAFE, SMART,
SOLUTIONS FOR IOWA

Call 515-281-4367 for more information or log-on at
www.safesmartsolutions.org

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